JOINT GEOLOGICAL SOCIETY OF NEW ZEALAND & NEW ZEALAND GEOPHYSICAL SOCIETY CONFERENCE LAUNCHING INTERNATIONAL YEAR OF PLANET EARTH

PROGRAMME & ABSTRACTS

New Zealand Geophysical Society (Inc)

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26-29 NOVEMBER
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GEOLOGICAL SOCIETY OF NEW ZEALAND & NEW ZEALAND GEOPHYSICAL SOCIETY JOINT ANNUAL CONFERENCE

Launching International Year of Planet Earth
26-29 November 2007
Baycourt Community and Arts Centre, Tauranga

New Zealand
Geophysical Society Inc.

Programme and Abstracts

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MAGMATIC AND PHREATOMAGMATIC TEPHRAS IN FINE ASH SUCCESSIONS OF AN ARC VOLCANIC COMPLEX, THE MANGATAWAI TEPHRA FORMATION, TONGARIRO VOLCANIC CENTRE, NEW ZEALAND

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Fine ash represents a significant volumetric proportion of eruptive products at arc-related composite volcanoes. However, due to difficulties in interpreting fragmentation, transportation and depositional histories, these deposits are commonly overlooked in volcanic studies. Here we present new results that contribute to the interpretation of volcanic processes from fine ash deposits, The Mangatawai Tephra Formation (MTF), defined by Topping (1973), represents the early eruptive history of Ngauruhoe, the youngest cone of the Tongariro volcano complex in the central North Island, New Zealand. The layers of fine ash of the MTF were deposited between 2500 to 1800 yrs B.P (Fergusson and Rafter, 1959). MTF consists of a series of 30-60 individual layers of fine ash, each representing individual eruptions or clusters of closely-spaced events. Textural characteristics such as laminar-bedding, cross-bedding, wavy structures and occasional presence of core type accretionary lapilli suggest that the MTF is a complex succession of distal fall and pyroclastic surge units. The colour of individual layers is a very distinctive feature of the MTF with variations from pale-grey, red, purple to black which appear to result from a combination of different eruption styles, weathering and possibly different sources. The grain-size distribution and the unit lithologies suggest that the MTF succession was not exclusively derived from Ngauruhoe volcano: 20–40 % of the layers may be derived from Ruapehu. Subtle geochemical differences as well as contrasts in the morphology of the glass shards and titanomagnetites can be used in some cases to distinguish the dual sources.

The very fine grained nature of the tephra layers and highly fragmented ash particles, together with textural features such as vesicular deposits and the presence of accretionary lapilli indicate some magma–water interaction (phreatomagmatic eruptions) causing fragmentation of the magma. The deposits are often very thin, show undulating wavy bedding and poor sorting, all indicators of pyroclastic surges. If so, these are unusually widely distributed surges, reaching up to 12 km. The 1974/75 eruptions of Ngauruhoe exhibited vulcanian and strombolian style eruptions, but did not produce surges travelling beyond one kilometre. An alternative explanation of these layers could be that they were deposited by rain-flushing of tephra clouds.

The different eruption styles of the individual layers of the Mangatawai Tephra Formation were also assessed by SEM examination of selected volcanic glass shards. Morphological analyses of volcanic glass shards of the youngest member of the Tufa Trig Formation derived from the Ruapehu 1995-96 eruption revealed evidence of a complex magmatic and phreatomagmatic fragmentation history. This is in good agreement with direct observational records of phreatomagmatic and strombolian eruptions phases. The results of this comparison were then applied to the different layers of the MTF and eruption products of the 1995-96 Ruapehu eruptions and confirm the interpretation of a phreatomagmatic origin based on field characteristics.

TALK – Tue pm

Magmaticand phreatomagmatic tephras in fine ash successions of an arc volcanic complex, the Mangatawai Tephra Formation, Tongariro Volcanic Centre, New Zealand

Moebis, Anja

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